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<u>L3</u>	L2 same (smaller or lower or less or greater or higher or larger)	20	<u>L3</u>
<u>L2</u>	L1 near9 (lead-in or lead-out or toc)	150	<u>L2</u>
<u>L1</u>	format near5 (record\$ or write or writing)	23701	<u>L1</u>

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L3: Entry 3 of 20

File: USPT

Jul 23, 2002

DOCUMENT-IDENTIFIER: US 6424615 B1

TITLE: Optical disk having plurality of volumes, recording device and reproduction device for same

Abstract Text (1):

An optical disk has a recording surface which is divided in the radial direction of the optical disk into a plurality of volumes. Each volume consists of a lead-in area, a program area and a lead-out area. Each of the volumes has a recording capacity which is not constant and has absolute position information recorded therein. The absolute position information consists of time information starting from a common initial value. The lead-in area, program area and lead-out area of the respective volumes is adapted to have information of the Compact Disc format recorded therein and adapted to have volume number information corresponding to the volume number thereof recorded in a predetermined position of the area. In one aspect of the invention, a part or all of the volumes has a higher recording density than a standard recording density determined by the Compact Disc format and absolute address information continuously increments from an initial value without overlapping among the respective volumes and address information is independent from the absolute address information. In another aspect of the invention, address information and absolute address information recorded in the first volume are within a range determined by the Compact Disc format and address information and absolute address information recorded in the second and subsequent volumes are larger than a value determined by the Compact Disc format.

Brief Summary Text (23):

For achieving the second object of the invention, there is provided an optical disk having a recording surface on which information prepared in accordance with a CD format is recorded and which is divided in the radial direction of the disk into a plurality of volumes each comprising a combination of a lead-in area, a program area and a lead-out area, a part or all of said volumes having a higher recording density than a standard recording density determined by the CD format, absolute address information recorded in the program area and the lead-out area of each of said volumes being made of address information which continuously increments from an initial value without overlapping among the respective volumes, and address information recorded in the lead-in area of each of said volumes is made of address information of a system which is independent from the absolute address information recorded in the program area and the lead-out area.

Brief Summary Text (33):

For achieving the above described third object of the invention, there is provided an optical disk having a recording surface on which information prepared in accordance with a CD format is recorded and which is divided in the radial direction of the optical disk into a plurality of volumes each comprising a combination of a lead-in area, a program area and a lead-out area, information being recorded in an innermost first volume with a standard recording density determined by the CD format and information being recorded in a second and subsequent volumes on the outer peripheral side of the optical disk with a recording density which is higher than the standard recording density determined by the CD format, address information recorded in the lead-in area of the first volume and absolute address information recorded in the program area and the lead-out area of the first volume being made of address information within a range determined by the CD format and address information recorded in the lead-in area of the second and subsequent volumes being made of address information which is larger than a value determined by the CD format.

CLAIMS:

18. An optical disk as defined in claim 17 wherein a part or all of said volumes have a higher recording density than a standard recording density determined by the Compact Disc format, and the first address information recorded in the program area and the lead-out area of each of said volumes is comprised of address information which continuously increments from an initial value without overlapping among the respective volumes.

24. An optical disk having a recording surface on which information prepared in accordance with a Compact Disc format is recorded and which is divided in a radial direction of the optical disk into a plurality of volumes each comprising a combination of a lead-in area, a program area and a lead-out area, absolute address information recorded in the program area and the lead-out area of each of said volumes being comprised of address information which does not overlap among the respective volumes, address information recorded in the lead-in area of each of said volumes being comprised of address information which is distinguishable from the absolute address information recorded in the program area and the lead-out area, a part or all of said volumes having a higher recording density than a standard recording density determined by the Compact Disc format, the absolute address information recorded in the program area and the lead-out area of each of said volumes being comprised of address information which continuously increments from an initial value without overlapping among the respective volumes, wherein address information recorded in the lead-in area of an innermost first volume is comprised of address information within a range determined by the Compact Disc format and address information recorded in the lead-in area of a second volume is comprised of address information which increments from the inner peripheral side of the disk and in which a digit of 10 of minute information is formed in hexadecimal and a final value ends with F9 minute, 59 second, 74 frame.

27. An optical disk having a recording surface on which information prepared in accordance with a Compact Disc format is recorded and which is divided in a radial direction of the optical disk into a plurality of volumes each comprising a combination of a lead-in area, a program area and a lead-out area, the program area and the lead-out area of the respective volumes recording first address information, the lead-in area of the respective volumes recording second address information, the first address information and the second address information recorded in one of said volumes being comprised of address information within a range determined by the Compact Disc format, the second address information recorded in volumes other than the one of said volumes being comprised of address information having a value which is greater than the range determined by the Compact Disc Format, wherein information is recorded in an innermost first volume with a standard recording density determined by the Compact Disc format and information is recorded in a second and subsequent volumes on an outer peripheral side of the optical disk with a recording density which is higher than the standard recording density determined by the Compact Disc format, the second address information recorded in the lead-in area of the first volume and the first address information recorded in the program area and the lead-out area of the first volume being comprised of the address information within the range determined by the Compact Disc format and the second address information recorded in the lead-in area of the second and subsequent volumes being comprised of the address information which is larger than the value determined by the Compact Disc format.

36. An optical disk reproduction device for reproducing an optical disk having a recording surface on which information prepared in accordance with a Compact Disc format is recorded and which is divided in a radial direction of the optical disk into a plurality of volumes each comprising a combination of a lead-in area, a program area and a lead-out area, address information recorded in the lead-in area of a part of said volumes and absolute address information recorded in the program area and the lead-out area of the respective volumes being comprised of address information within a range determined by the Compact Disc format and address information recorded in the lead-in area of volume other than the part of said volumes being comprised of address information which is larger than a value determined by the Compact Disc format, said optical disk reproduction device

including a circuit which analyzes address information within a range determined by the Compact Disc format and address information of a larger value than the value determined by the Compact Disc format and a control circuit which reads, during reproduction of each of said volumes, the information indicating existence of a next volume and, when the information indicating existence of the next volume is available, allows access to the next volume whereas, when the information indicating the next volume is not available, prohibits access beyond the current volume.



US006424615B1

(12) **United States Patent**
Ishimura et al.

(10) Patent No.: **US 6,424,615 B1**
(45) Date of Patent: ***Jul. 23, 2002**

(54) **OPTICAL DISK HAVING PLURALITY OF VOLUMES, RECORDING DEVICE AND REPRODUCTION DEVICE FOR SAME**

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(73) Assignee: **Yamaha Corporation**, Hamamatsu (JP)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/217,802**

(22) Filed: **Dec. 21, 1998**

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Jan. 29, 1998 (JP) 10-032064

(51) Int. Cl.⁷ **G11B 7/24; G11B 7/00**

(52) U.S. Cl. **369/275.3; 369/59.25; 369/53.41**

(58) Field of Search 369/275.3, 275.1, 369/32, 58, 54, 48, 59, 47, 30, 33, 53.41, 53.44, 47.54, 59.25, 30.03

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(57) **ABSTRACT**

An optical disk has a recording surface which is divided in the radial direction of the optical disk into a plurality of volumes. Each volume consists of a lead-in area, a program area and a lead-out area. Each of the volumes has a recording capacity which is not constant and has absolute position information recorded therein. The absolute position information consists of time information starting from a common initial value. The lead-in area, program area and lead-out area of the respective volumes is adapted to have information of the Compact Disc format recorded therein and adapted to have volume number information corresponding to the volume number thereof recorded in a predetermined position of the area. In one aspect of the invention, a part or all of the volumes has a higher recording density than a standard recording density determined by the Compact Disc format and absolute address information continuously increments from an initial value without overlapping among the respective volumes and address information is independent from the absolute address information. In another aspect of the invention, address information and absolute address information recorded in the first volume are within a range determined by the Compact Disc format and address information and absolute address information recorded in the second and subsequent volumes are larger than a value determined by the Compact Disc format.

36 Claims, 15 Drawing Sheets

